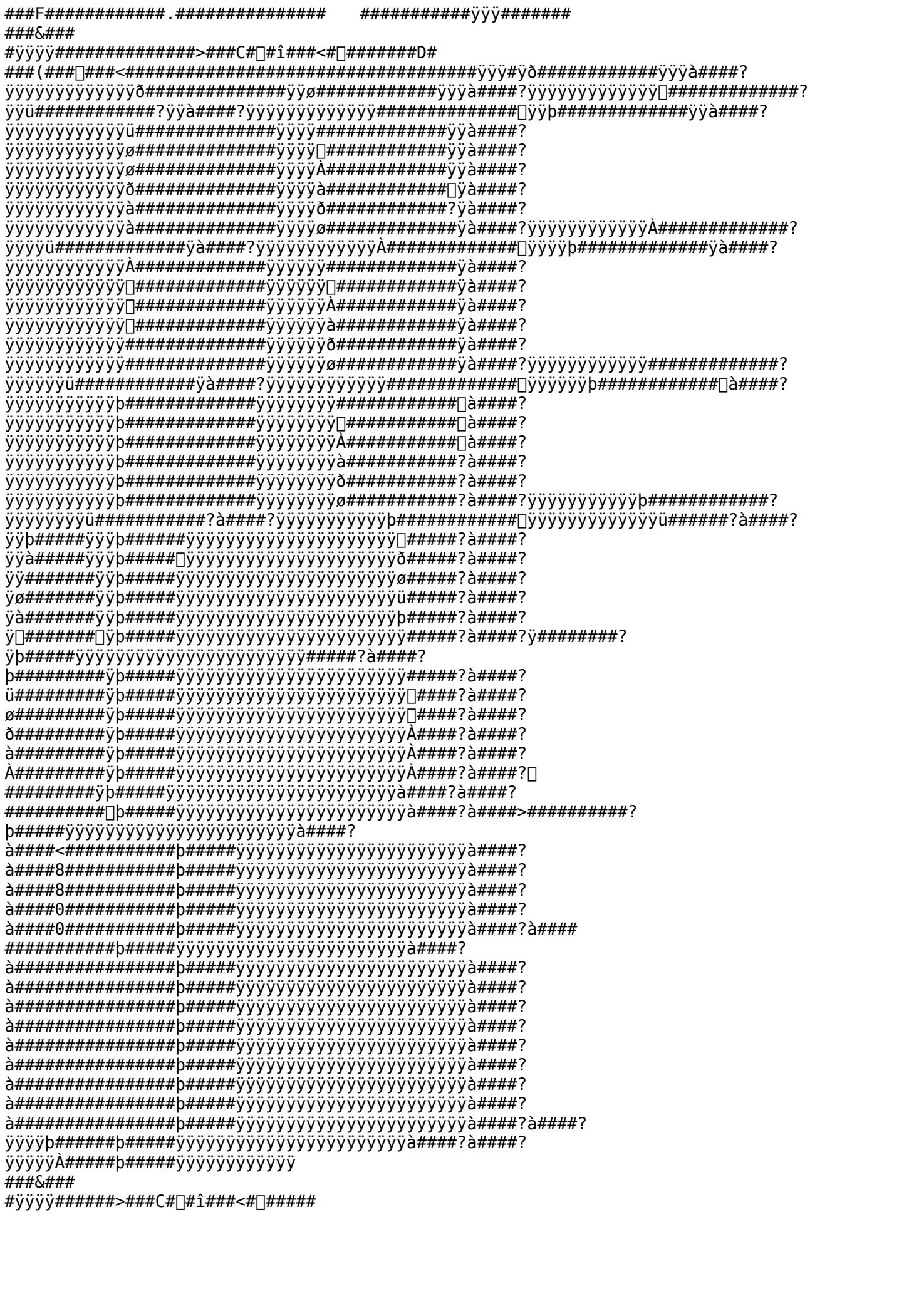

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      r#ÿÿ####ÿÿ#####ÿ¥#ÿÿd#########d#2###########CALIFORNIA INSTITUTE OF
TECHNOLOGYTHE JET PROPULSION LABORATORYPRESENTATION ONDEPARTMENT OF ENERGY (DOE-
PV) / SANDIA NATIONAL LABS (SNL-PV)THRUSTS IN PV POWER CONDITIONERSATHarris
Semiconductor CorporationMelbourne, FloridaBYStan KrauthamerMarch 27, 1996
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¡#ÿÿ####ÿÿ#####ÿ¥#ÿÿd#########d#########§###PROVIDE REQUIREMENT FEEDBACK FROM THE PV COMMUNITY TO THE PEBB PROGRAMTAP THE PV INDUSTRY TO IDENTIFY POWER PROCESSOR REQUIREMENTSEFFICIENCY COST GOALSTAP THE FEDERAL LABORATORIES TO IDENTIFY POWER PROCESSOR REQUIREMENTSIDENTIFY VARIOUS STANDARDS AND SAFETY ISSUES FOR PV SYTEMS THAT CAN BE FACTORED INTO PEBB REQUIREMENTSIEEEIECPROVIDE TECHNICAL SUPPORT TO FURTHER THE PEBB TECHNICAL REVIEWSJOURNAL PUBLICATIONS#

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s#ÿÿ####ÿÿ#####ÿ¥#ÿÿd#########d#########æ###PV ARRAY DOMINANT COST DRIVER ($4.0 - $8.0/PEAK WATT)PCS COST IN THE RANGE OF $0.5 - $1.5/MAX RATED WATT OUTPUTBOS COST IN THE RANGE OF $1.0 - $4.0/WATTPCS IN CRITICAL PATH THAT AFFECTS ARRAY, BOS AND DELIVERED COST OF POWER

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s#ÿÿ####ÿÿ#####ÿ¥#ÿÿd#########d#########4###THE PV DOE/SNL PROGRAM IN POWER
CONDITIONERS COVERS A BROAD POWER RANGE FROM 100W TO 10 MEGAWATTS (CENTRAL
STATION)A REVOLUTION IN BOTH PV SYSTEMS AND POWER CONDITIONERS IS IN THE MAKING
BY VIRTUE OF  MAJOR ADVANCES IN SMART POWER/POWER INTEGRATION TECHNOLOGYTHIS
REVOLUTION WILL HAVE DRAMATIC IMPACTS ON RELIABILITY IMPROVEMENT, EFFICIENCY AND
OVERALL SYSTEM COST REDUCTIONTHIS TECHNOLOGY IS ALSO APPLICABLE TO RENEWABLE
ENERGY SYSTEMSA SMART POWER THRUST HAS BEEN APPROVED FOR INCORPORATION INTO SBIR
PROGRAMS SEVERAL SMART POWER CONTRACTS HAVE BEEN AWARDED
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s#ÿÿ####ÿÿ#####ÿ¥#ÿÿd#########□#########□###IT IS APPROPRIATE FOR DOE-PV AND OTHER RENEWABLES TO TAP INTO THE SP/PICS TECHNOLOGY BASE AND PROVIDE THE NECESSARY SPIN-OFF OF THESE TECHNOLOGIES TO PV PCU MANUFACTURERS AND UTILITIES. THE PV PROGRAM IS ORIENTED TOWARD AN R&D ELEMENT. THE PROGRAM RECOGNIZES THE IMPORTANCE OF THE PEBB PROGRAM AND ITS IMPACTS ON THE FUTURE GENERATIONS OF PV POWER CONDITIONERS. AS A RESULT, BOTH THE DOE-PV AND SNL-PV ARE ASSIGNING S. KRAUTHAMER OF JPL TO COORDINATE THE PV NEEDS WITH THE PEBB PROGRAMTHIS ENABLING TECHNOLOGY (PEBB) WILL BE, BY AND LARGE, FOOL-PROOF AND NOT DEPENDENT ON THE DESIGN ABILITY OF PCU MANUFACTURERS AND USERS IN ADOPTING THE PV SYSTEMO

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Süÿÿ####ÿÿ#####ÿ¥#ÿÿd#########d#2#######D###COMMERCIALLY AVAILABLE PCS GOALS AND
ATTAINED COSTS AND PERFORMANCES

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½#ÿÿ####ÿÿ#####ÿ¥#ÿÿd#########d#2#######b###CONCLUSION: EXISTING PCS
TECHNOLOGY DID NOT MEET THE US.. DOE COST AND PERFORMANCE GOALS

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      ó#ÿÿ####ÿÿ#####ÿ¥#ÿÿd#########d#########S###EFFORTS CONCENTRATED IN SMALL
STAND-ALONE PV,  RESIDENTIAL AND INTERMEDIATE UTILITY-INTERACTIVE PV SYSTEMS
FOCAL POINT OF ACTIVITY TO ASSURE VIABILITY OF PV SYSTEMS AS AN ALTERNATIVE
POWER SOURCE:DEVELOPMENT OF LOW COST, HIGHLY-EFFICIENT AND RELIABLE PCS IN SMALL
TO MEDIUM POWER RANGECURRENT DESIGNS USEHUNDREDS OF DISCRETE PARTSSOME NEW
TECHNOLOGIES HAVE POTENTIAL FOR IMPROVED EFFICIENCY AND RELIABILITYSMART POWER /
POWER INTEGRATED CIRCUITSASICsNOVEL IC ARCHITECTUREIMPROVED PACKAGINGPEBB
TECHNOLOGIESONLY A LIMITED NUMBER OF DEVICES ARE CURRENTLY AVAILABLE FOR PCS
IMPLEMENTATIONÿ
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s#ÿÿ####ÿÿ#####ÿ¥#ÿÿd#########d#########.###PCS RELIABILITY HAS CONTINUALLY BEEN QUESTIONABLE IN THE PAST-FIELDED PV SYSTEMSPCS IS THE MOST IMPORTANT ELEMENT IN THE PV BOSTHE ENTIRE PV SYSTEM IS AS RELIABLE AS ITS ASSOCIATED POWER CONDITIONING SYSTEMA VAST DIVERSITY OF DESIGNS AND COMPONENTS USED PRECLUDE RELIABLE AND STANDARDIZED DESIGNS

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s##############ÿ□#ÿÿd#########□#########û###IMPROVE SYSTEM RELIABILITY
ALLOW STANDARDIZATION OF POWER MODULES (REDUCED COST) AND IMPROVED CONTROL
IMPROVE SYSTEM EFFICIENCY, REDUCE COST & PARTS COUNTREDUCE ACOUSTICAL NOISE
TECHNOLOGY DEVELOPED HAS APPLICATIONS TO OTHER RENEWABLE ENERGY SYSTEMS#

##ÿ□#ÿÿd######0##d#########3##□##zö-ü□ í#ÿÿ####ÿÿ#####ÿ¥#ÿÿd#########d#2#######[###THE IDEA OF ORGANIZING THIS WORKSHOP ON SMART POWER / PIC TECHNOLOGY AND ITS APPLICATIONS STEMMED FROM THE REALIZATION THAT THE FULL POTENTIAL OF THIS TECHNOLOGY CANNOT BE UTILIZED WITHOUT UNDERSTANDING WHAT THIS TECHNOLOGY IS AND WHAT ITS STRENGTHS AND WEAKNESSES ARE FOR A GIVEN APPLICATION SUCH AS PHOTOVOLTAIC POWER SYSTEM. IT WAS ALSO REALIZED THAT ALTHOUGH THIS TECHNOLOGY HAS AN ESTABLISHED ADVANTAGE IN AUTOMOTIVE, TELECOMMUNICATIONS, AND APPLIANCE SYSTEMS, ITS SUPERIOR AVAILABILITY IN PHOTOVOLTAIC POWER SYSTEMS MUST BE INVESTIGATED IN TERMS OF RELIABILITY, COST, VOLUME, EFFICIENCY AND MASS.1

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Ó#ÿÿ####ÿÿ#####ÿ¥#ÿÿd#########d#########□###DOE COST AND PERFORMANCE GOALS FOR PV-PCS ARE CURRENTLY NOT METPV-PCS MUST BE HIGHLY EFFICIENT, RELIABLE AND SAFE. PV SYSTEM MUST BE ECONOMICAL AND A SOURCE OF AC POWER THAT IS OF UTILITY-GRADE QUALITYPRESENT FOCUS ON SMALL AND INTERMEDIATE-SIZE PCS DESIGNS - AC PV MODULE / STAND-ALONE PV SYSTEMS, ETC.SYNERGISM WITH OTHER APPLICATION SECTORS MUST BE ESTABLISHED FOR LARGE SCALE PRODUCTION OF SP/PIC DEVICES FOR LOW COST PV-PCSTECHNOLOGICAL BARRIERS MUST BE OVERCOME. THIS IS POSSIBLE WITH SYNERGISM AND UNIVERSITY / INDUSTRY / LABORATORY PARTNERSHIPSCOORDINATED ACTIVITIES WITH THE PEBB PROGRAM IS A KEY ELEMENT IN THE PV R&D PERSPECTIVE#